

Atty. Dkt. No. QUANT1390
(028248-3201)

REMARKS

By the present communication, claims 38 and 39 have been amended to define Applicant's invention with greater particularity. No new matter has been introduced by the subject amendments as the amended claim language is fully supported by the specification and original claims. Accordingly, claims 1-42 remain pending. A complete listing of the claims as amended is provided herewith, beginning on page 2.

In accordance with the present invention, there are provided adhesive compositions comprising at least one maleimide-containing monomer, optionally at least one cure initiator, and a plurality of spacers constructed from one or more organic polymers. Invention adhesive compositions are useful for controlling bond line thickness and planarity between a device and a substrate, or between semiconductor dies in a stacked die package. Bond line thickness and planarity are largely determined by the size of the spacers in the adhesive composition.

In further aspects of the invention, there are provided methods for creating a substantially uniform bond line between a device and a substrate; methods for controlling adhesive gap thickness between a device and a substrate; methods for controlling planarity across an adhesive bond line; methods for creating substantially uniform bond lines between at least one semiconductor die attached to a substrate in a stacked arrangement; and methods for adhesively attaching at least two semiconductor dies to the substrate in a stacked arrangement without the need for a spacer die.

The rejection of claims 38 and 39 under 35 U.S.C. § 101 as allegedly being directed to non-statutory subject matter has been obviated by the amendments submitted herewith. Thus, as amended, claims 38 and 39 are directed to an article which is defined, in part, by the presence of a defined bond line.

The rejection of claims 1-23, 26-29, 41 and 42 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Dershem '962 (U.S. Patent No. 5,232,962) in view of Dershem '194 (U.S. Patent No. 6,034,194) is respectfully traversed. Applicant's invention, as defined, for

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example, by claim 1, distinguishes over the applied references at least by requiring maleimide-based adhesive compositions comprising a plurality of spacers constructed from one or more organic polymers. Indeed, as acknowledged by the Examiner, "[t]he difference between the prior art and the present invention is the inclusion of a maleimide-containing monomer in the adhesive composition in the present invention." (See page 3, lines 17-18 of the Office Action.)

While each of the Dershem patents represent a significant advance in the art, only the present application teaches the combination of a maleimide-based adhesive composition and a plurality of spacers constructed from one or more organic polymers. Only the present application teaches the compatibility of these two components. Only the present application teaches the benefits obtained by combining these two components.

The rejection of claims 24 and 25 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Dershem '962 in view of Dershem '194 and Dershem '034 (U.S. Patent No. 5,717,034) is respectfully traversed. Applicant's invention, as defined for example by claim 24, distinguishes over the applied references at least by requiring a maleimide-based adhesive composition comprising a plurality of spacers constructed from one or more organic polymers, and at least one non-conductive filler different from the spacer. As acknowledged by the Examiner, "[t]he difference between the prior art and the present invention is the use of organic polymer-based filler in the adhesive compositions." (See page 5, lines 5-6 of the Office Action.)

While each of the Dershem patents represent a significant advance in the art, only the present application teaches the combination of a maleimide-based adhesive composition containing a plurality of spacers constructed from one or more organic polymers and at least one non-conductive filler different from the spacer. Only the present application teaches the compatibility of these three components. Only the present application teaches the benefits contained by combining these three components.

The rejections of claims 1-6, 12-20, 8 [sp-28?]-39, 41 and 42 under 35 U.S.C. § 102(b) as allegedly being anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as allegedly being

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obvious over Dershem '034 are respectfully traversed. Applicant's invention, as defined for example by claim 1, distinguishes over Dershem '034 at least by requiring a maleimide-based adhesive composition containing a plurality of spacers. As defined in Applicant's specification (see, for example, the 2nd, 3rd, and 4th paragraphs at page 4 of the specification), the plurality of spacer particles will typically have some degree of uniformity so as to achieve a uniform bond line. In contrast, addition of filler to an adhesive formulation, for instance, to alter the rheology thereof, may embrace a range of particle sizes, which would not be suitable for providing a uniform bond line.

Applicant's invention, as defined for example by new claim 43 (original claim 3 re-written in independent form), distinguishes over Dershem '034 at least by requiring a maleimide-based adhesive composition containing a plurality of spacers, wherein the spacers have a particle size in the range of about 0.02 mils up to about 25 mils. Only the present application teaches the use of spacers having the required range of particle sizes.

Applicant's invention, as defined for example by new claim 44 (original claim 7 re-written in independent form), distinguishes over Dershem '034 at least by requiring a maleimide-based adhesive composition containing a plurality of spacers, wherein the organic polymers are polymerization or copolymerization products of α -olefins, (meth)acrylates, vinyl esters, acrylamides, or acrylonitriles. Only the present application teaches the use of spacers made from the recited polymers or co-polymers.

The indication that claim 40 is allowable is acknowledged with appreciation. By the present communication, claim 40 has been re-written in independent form. Accordingly, claim 40 is submitted to be in condition for allowance.

In view of the above amendments and remarks, reconsideration and favorable action on all claims is respectfully requested. In the event any issues remain to be resolved in view of this

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communication, the Examiner is invited to contact the undersigned at the telephone number given below so that a prompt disposition of this application can be achieved.

Respectfully submitted,

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FOLEY & LARDNER

Customer Number: 30542

Telephone: (858) 847-6711

Facsimile: (858) 792-6773

By



Stephen E. Reiter
Attorney for Applicant
Registration No. 31,192